

## Radio and Telecommunications Equipment Installers and Repairers

(O\*NET 49-2021.00, 49-2022.01, 49-2022.02, 49-2022.03, 49-2022.04, 49-2022.05)

### Significant Points

- Employment is projected to decline.
- Applicants with electronics training and computer skills should have the best opportunities.
- Weekend and holiday hours are common; repairers may be on call around the clock in case of emergencies.

### Nature of the Work

Telephones and radios depend on a variety of equipment to transmit communications signals. Electronic switches route telephone signals to their destinations. Switchboards direct telephone calls within a single location or organization. Radio transmitters and receivers relay signals from wireless phones and radios to their destinations. Newer telecommunications equipment is computerized and can communicate a variety of information, including data, graphics, and video. The workers who set up and maintain this sophisticated equipment are radio and telecommunications equipment installers and repairers.

*Central office installers* set up switches, cables, and other equipment in central offices. These locations are the hubs of a telecommunications network—they contain the switches and routers that direct packets of information to their destinations. *PBX installers and repairers* set up private branch exchange (PBX) switchboards, which relay incoming, outgoing, and interoffice calls within a single location or organization. To install switches and switchboards, installers first connect the equipment to power lines and communications cables and install frames and supports. They test the connections to ensure that adequate power is available and that the communication links function. They also install equipment such as power systems, alarms, and telephone sets. New switches and switchboards are computerized; workers install software or may program the equipment to provide specific features. For example, as a cost-cutting feature, an installer may program a PBX switchboard to route calls over different lines at different times of the day. However, other workers, such as computer support specialists, rather than installers, generally handle complex programming. (The work of computer support specialists is described in the *Handbook* statement on computer support specialists and systems administrators.) Finally, the installer performs tests to verify that the newly installed equipment functions properly.

The increasing reliability of telephone switches and routers has simplified maintenance. New telephone switches are self-monitoring and alert repairers to malfunctions. Some switches allow repairers to diagnose and correct problems from remote locations. When faced with a malfunction, the repairer may refer to manufacturers' manuals that provide maintenance instructions. PBX repairers determine if the problem is located within the PBX system, or if it originates in the telephone lines maintained by the local phone company.

When problems with telecommunications equipment arise, telecommunications equipment repairers diagnose the source of the problem by testing each of the different parts of the equipment, which requires an understanding of how the software and hardware interact. Repairers often use spectrum and/or network analyzers to locate the problem. A network analyzer sends a signal through the equipment to detect any distortion in the signal. The nature of the

signal distortion often directs the repairer to the source of the problem. To fix the equipment, repairers may use small hand tools, including pliers and screwdrivers, to remove and replace defective components such as circuit boards or wiring. Newer equipment is easier to repair, since whole boards and parts are designed to be quickly removed and replaced. Repairers also may install updated software or programs that maintain existing software.

*Station installers and repairers, telephone*—commonly known as *telephone installers and repairers*—install and repair telephone wiring and equipment on customers' premises. They install telephone service by connecting customers' telephone wires to outside service lines. These lines run on telephone poles or in underground conduits. The installer may climb poles or ladders to make the connections. Once the telephone is connected, the line is tested to insure that it receives a dial tone. When a maintenance problem occurs, repairers test the customers' lines to determine if the problem is located in the customers' premises or in the outside service lines. When onsite procedures fail to resolve installation or maintenance problems, repairers may request support from their technical service center. Line installers and repairers, covered elsewhere in the *Handbook*, install the wires and cables that connect customers with central offices.

*Radio mechanics* install and maintain radio transmitting and receiving equipment. This includes stationary equipment mounted on transmission towers and mobile equipment, such as radio communications systems in service and emergency vehicles. Their work



*Radio mechanics install and maintain radio transmitting and receiving equipment.*

does not include cellular communications towers and equipment. Newer radio equipment is self-monitoring and may alert mechanics to potential malfunctions. When malfunctions occur, these mechanics examine equipment for damaged components and loose or broken wires. They use electrical measuring instruments to monitor signal strength, transmission capacity, interference, and signal delay, as well as hand tools to replace defective components and parts and to adjust equipment so it performs within required specifications.

### Working Conditions

Radio and telecommunications equipment installers and repairers generally work in clean, well-lighted, air-conditioned surroundings, such as a telephone company's central office, a customer's PBX location, or an electronic repair shop or service center. Telephone installers and repairers work on rooftops, ladders, and telephone poles. Radio mechanics may maintain equipment located on the tops of transmissions towers. While working outdoors, these workers are subject to a variety of weather conditions.

Nearly all radio and telecommunications equipment installers and repairers work full time. Many work regular business hours to meet the demand for repair services during the workday. Schedules are more irregular at companies that need repair services 24 hours a day or where installation and maintenance must take place after business hours. At these locations, mechanics work a variety of shifts, including weekend and holiday hours. Repairers may be on call around the clock, in case of emergencies, and may have to work overtime.

The work of most repairers involves lifting, reaching, stooping, crouching, and crawling. Adherence to safety precautions is important to guard against work hazards. These hazards include falls, minor burns, electrical shock, and contact with hazardous materials.

### Employment

Radio and telecommunications equipment installers and repairers held about 196,000 jobs in 2000. About 189,000 were telecommunications equipment installers and repairers, except line installers, and the rest were radio mechanics. Most worked for telephone communications companies but many radio mechanics worked in electrical repair shops.

### Training, Other Qualifications, and Advancement

Most employers seek applicants with postsecondary training in electronics and a familiarity with computers. Training sources include 2- and 4-year college programs in electronics or communications, trade schools, and equipment and software manufacturers. Military experience with communications equipment is highly valued by many employers.

Newly hired repairers usually receive some training from their employers. This may include formal classroom training in electronics, communications systems, or software and informal, hands-on training with communications equipment. Large companies may send repairers to outside training sessions to keep these employees informed of new equipment and service procedures. As networks have become more sophisticated—often including equipment from a variety of companies—the knowledge needed for installation and maintenance also has increased.

Repairers must be able to distinguish colors, because wires are color-coded, and they must be able to hear distinctions in the various tones on a telephone system. For positions that require climbing poles and towers, workers must be in good physical shape. Repairers who handle assignments alone at a customer's site must be able to work without close supervision. For workers who frequently contact customers, a pleasant personality, neat appearance, and good communications skills also are important.

Experienced repairers with advanced training may become specialists or troubleshooters who help other repairers diagnose difficult problems, or may work with engineers in designing equipment and developing maintenance procedures. Because of their familiarity with equipment, repairers are particularly well qualified to become manufacturers' sales workers. Workers with leadership ability also may become maintenance supervisors or service managers. Some experienced workers open their own repair services or shops or become wholesalers or retailers of electronic equipment.

### Job Outlook

Employment of radio and telecommunications equipment installers and repairers is expected to decline through 2010. Although the need for installation work will grow as companies seek to upgrade their telecommunications networks, there will be a declining need for maintenance work—performed by telecommunications equipment installers and repairers, except line installers—because of increasingly reliable self-monitoring and self-diagnosing equipment. The replacement of two-way radio systems by wireless systems, especially in service vehicles, has eliminated the need in many companies for onsite radio mechanics. The increased reliability of wireless equipment and the use of self-monitoring systems also will continue to lessen the need for radio mechanics. Applicants with electronics training and computer skills should have the best opportunities for radio and telecommunications equipment installer and repairer jobs.

Job opportunities will vary by specialty. For example, opportunities should be available for central office and PBX installers and repairers as the growing popularity of the Internet, expanded multimedia offerings such as video on demand, and other telecommunications services continue to place additional demand on telecommunications networks. These new services require high data transfer rates, which can only be achieved by installing new optical switching and routing equipment. Extending high speed communications from central offices to customers also will require the installation of more advanced switching and routing equipment. Whereas increased reliability and automation of switching equipment will limit opportunities, these effects will be offset by the strong demand for installation and upgrading of switching equipment.

Station installers and repairers, on the other hand, can expect keen competition. Pre-wired buildings and the increasing reliability of telephone equipment will reduce the need for installation and maintenance of customers' telephones. The number of pay phones is declining as cellular telephones have increased in popularity, which also will adversely affect employment in this specialty as pay phone installation and maintenance is one of their major functions.

### Earnings

In 2000, median hourly earnings of telecommunications equipment installers and repairers, except line installers were \$21.17. The middle 50 percent earned between \$16.55 and \$24.99. The bottom 10 percent earned less than \$12.04, whereas the top 10 percent earned more than \$27.23. Median hourly earnings in the telephone communications industry were \$22.88 in 2000.

Median hourly earnings of radio mechanics in 2000 were \$15.86. The middle 50 percent earned between \$12.57 and \$20.60. The bottom 10 percent earned less than \$9.39, whereas the top 10 percent earned more than \$25.62.

### Related Occupations

Related occupations that work with electronic equipment include broadcast and sound engineering technicians and radio operators; computer, automated teller, and office machine repairers; electronic home entertainment equipment installers and repairers; and electrical

and electronics installers and repairers. Engineering technicians also may repair electronic equipment as part of their duties.

#### Sources of Additional Information

For information on career opportunities, contact:

➤ International Brotherhood of Electrical Workers, Telecommunications Department, 1125 15th St. NW., Room 807, Washington, DC 20005.

➤ Communications Workers of America, 501 3rd St. NW., Washington, DC 20001. Internet: <http://www.cwa-union.org>

For information on careers and schools, contact:

➤ Electronics Technicians Association International, 502 North Jackson, Greencastle, IN 46135. Internet: <http://www.eta-sda.com>

➤ National Association of Radio and Telecommunications Engineers, P.O. Box 678, Medway, MA 02053. Internet: <http://www.narte.org>

## Vehicle and Mobile Equipment Mechanics, Installers, and Repairers

### Aircraft and Avionics Equipment Mechanics and Service Technicians

(O\*NET 49-2091.00, 49-3011.01, 49-3011.02, 49-3011.03)

#### Significant Points

- The majority of these workers learn their job in 1 of about 200 trade schools certified by the Federal Aviation Administration.
- Opportunities should be favorable, but keen competition is likely for the best paying airline jobs.

#### Nature of the Work

To keep aircraft in peak operating condition, aircraft and avionics equipment mechanics and service technicians perform scheduled maintenance, make repairs, and complete inspections required by the Federal Aviation Administration (FAA).

Many aircraft mechanics, also called airframe, powerplant, and avionics aviation maintenance technicians, specialize in preventive maintenance. They inspect engines, landing gear, instruments, pressurized sections, accessories—brakes, valves, pumps, and air-conditioning systems, for example—and other parts of the aircraft, and do the necessary maintenance and replacement of parts. Inspections take place following a schedule based on the number of hours the aircraft has flown, calendar days since the last inspection, cycles of operation, or a combination of these factors. Large, sophisticated planes are equipped with aircraft monitoring systems, consisting of electronic boxes and consoles that monitor the aircraft's basic operations and provide valuable diagnostic information to the mechanic. To examine an engine, aircraft mechanics work through specially designed openings while standing on ladders or scaffolds, or use hoists or lifts to remove the entire engine from the craft. After taking an engine apart, mechanics use precision instruments to measure parts for wear and use x-ray and magnetic inspection equipment to check for invisible cracks. Worn or defective parts are repaired or replaced. Mechanics may also repair sheet metal or composite surfaces, measure the tension of control cables, and check for corrosion, distortion, and cracks in the fuselage, wings, and tail. After completing all repairs, they must test the equipment to ensure that it works properly.

Mechanics specializing in repairwork rely on the pilot's description of a problem to find and fix faulty equipment. For example, during a preflight check, a pilot may discover that the aircraft's fuel gauge does not work. To solve the problem, mechanics may troubleshoot the electrical system, using electrical test equipment to make sure that no wires are broken or shorted out, and replace



*Aircraft mechanics inspect, maintain, and replace engines and other parts of the aircraft.*

any defective electrical or electronic components. Mechanics work as fast as safety permits so that the aircraft can be put back into service quickly.

Some mechanics work on one or many different types of aircraft, such as jets, propeller-driven airplanes, and helicopters. Others specialize in one section of a particular type of aircraft, such as the engine, hydraulics, or electrical system. *Powerplant mechanics* are authorized to work on engines and do limited work on propellers. *Airframe mechanics* are authorized to work on any part of the aircraft except the instruments, powerplants, and propellers. *Combination airframe-and-powerplant mechanics*—called A & P mechanics—work on all parts of the plane, except instruments. The majority of mechanics working on civilian aircraft today are A & P mechanics. In small, independent repairshops, mechanics usually inspect and repair many different types of aircraft.

Avionics systems are now an integral part of aircraft design and have vastly increased aircraft capability. *Avionics technicians* repair and maintain components used for aircraft navigation and radio communications, weather radar systems, and other instruments and computers that control flight, engine, and other primary functions. These duties may require additional licenses, such as a radiotelephone license issued by the U.S. Federal Communications Commission (FCC). Because of technological advances, an increasing amount of time is spent repairing electronic systems, such as computerized controls. Technicians also may be required to analyze and develop solutions to complex electronic problems.